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## TRIGGER MECHANISM FOR FLUORESCENT TUBES

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#### 1. Claim of Priority.

This patent application claims priority from PCT application PCT/EP2003/009481 filed August 27, 2003, which claims the benefit of German patent application DE 102 39 370.2 filed August 28, 2002.

#### 2. Field of the Invention.

The invention relates to the field of control systems for fluorescent tubes, and in particular to a control system that monitors and controls the lamp currents for at least two fluorescent lamps using a day control mode and a night control mode.

#### 3. Related Art.

Displays of multimedia systems are often illuminated by fluorescent tubes. Several parallel arranged tubes may be used for illumination, especially for higher light output when an individual fluorescent tube has insufficient light output. An electronic trigger is required to operate the fluorescent tubes. For cost reasons, two fluorescent tubes may be hooked up in parallel to a trigger and operated with a single transformer circuit.

As known, due to tolerances in the characteristics of the fluorescent tubes, faults can occur. In this case, the current dictated by the trigger is not distributed uniformly over the parallel-connected fluorescent tubes. The parallel fluorescent tubes each have a negative internal resistance, i.e., the maximum ignition voltage occurs at minimum lamp current. Thus, a parallel arrangement of the tubes results in an unstable system, since the current may flow entirely

through the fluorescent tube with low resistance and leave the other fluorescent tube without current. By using series-connected ballast resistances or impedances, the lamp currents can be kept symmetrical at sufficient current strengths, since the ballast resistances determine the voltage divider ratio and thus, in turn, the currents in the two branches. However, when the current strength is relatively low, the voltage drop across the ballast resistances is so low that the voltage divider is determined by the now relatively high lamp resistance. The circuit can become asymmetrical even in the presence of low stray capacitances, which can totally disable a lamp. Although the control circuit, such as a controller IC, can register this as a drop below a predetermined minimum current value and reduce the lamp current (e.g., in a fault mode or error mode) and again ignite the lamp in a following burst mode to ignite the lamp once again, if the low current strength through this lamp continues then this behavior may repeat itself and the lamp will flicker. Therefore, when the brightness is set low (i.e., a high dim rate) the display may flicker.

There is a need for a trigger circuit for parallel arranged fluorescent tubes that prevents an unstable behavior of the lamps, such as flickering.

## **SUMMARY OF THE INVENTION**

The setting range or dim range of the lamp currents is divided into a brighter region (e.g., a day mode) and a darker region (e.g., night mode). Detection of the lamp currents is effected by a suitable control circuit, such as an integrated controller that receives a first lamp current signal and a second lamp current signal.

In the night mode, the lamp currents are evaluated jointly by the control circuit. The joint evaluation can occur by connecting the two detection inputs via a switch. This has the result that

when the behavior of the fluorescent tubes is asymmetrical, neither of the detection inputs recognizes a current that is so weak that it is reduced further. Therefore, the two tubes shine with constant, low brightness, and asymmetries due to the lower current strengths do not result in disruption of one of the fluorescent tubes. In the day mode with higher current strengths, a separate evaluation and setting of the currents.

Other systems, methods, features and advantages of the invention will be, or will become, apparent to one with skill in the art upon examination of the following figure and detailed description. It is intended that all such additional systems, methods, features and advantages be included within this description, be within the scope of the invention, and be protected by the following claims.

#### **DESCRIPTION OF THE DRAWINGS**

The invention can be better understood with reference to the following drawing and description. The components in the figure are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention. Moreover, in the figure, like reference numerals designate corresponding parts throughout the different views.

The FIGURE is a schematic illustration of a control system for fluorescent light tubes.

#### **DETAILED DESCRIPTION OF THE INVENTION**

A lamp circuit 1 includes a trigger mechanism 2 with a control circuit 3 ( e.g., a controller IC). Such a controller IC is available, for example, from Linear Technology under the model name LT1768. The trigger mechanism 2 includes a switch 4 that is connected between signal

lines DIO1 and DIO2. The switch 4 can be designed for example as a semiconductor switch, and the switch is opened in a day mode and closed in a night mode.

The lamp circuit 1 also includes a transformer circuit 5 that provides a current signal on a common connection line 14. The current signal is split to provide a first current signal I1 along a first current path S1 and a second current signal I2 along a second current path S2. The first current signal I1 along the first current path S1 is input to a first fluorescent tube 6 via a first ballast capacitor CL12, and the second current signal I2 along the second current path S2 is input a second fluorescent tube 7 via a second ballast capacitor CL13.

Connection contacts 8 and 10 for the fluorescent tubes 6, 7 are connected to the control circuit 3 via inputs DIO1, DIO2, respectively. The other connection contacts 9 and 11 of the fluorescent tubes 6 and 7 are connected to their associated ballast capacitors CL12 and CL13, so the two parallel and symmetrical current paths S1 and S2 are formed.

The control circuit 3 detects the lamp currents arriving via the detection inputs a2 and a3 and adjusts suitable lamp currents. In the day mode with higher current strengths, the switch 4 is in the open position, and the lamp currents I1, I2 each flow to the corresponding input a2 and a3, so that they can be detected and adjusted separately. In the night mode with lower current strengths and the switch 4 positioned in the closed position, the lamp currents I1, I2 of both inputs a2, a3 can be detected. The voltage dropping across the current paths S1 and S2 drops essentially across the fluorescent tubes 6 and 7 when the current strengths are low (e.g., during the night operating mode). If more asymmetrical behavior occurs (e.g., so that a smaller current I1 flows through the tube 6 in comparison to the tube 7), since the switch 4 is in the closed position, the control circuit inputs a2, as well as a3, will still take up both currents I1 and I2 or a portion of the sum of both currents. Since the switch 4 is in the closed position, failure of the

tube 6 is not recognized at the control circuit input a2 since the input also sees the second current signal. Advantageously, subsequent re-ignition of the tube 6 in a burst cycle is prevented. Therefore, in the night mode, a periodic reducing and reactivation of the current of the less-bright tube is prevented and uniform lighting – asymmetrical if desired – is achieved.

The illustration has been discussed with reference to functional blocks identified as modules and components that are not intended to represent discrete structures and may be combined or further sub-divided. In addition, while an embodiment of the invention has been described, it will be apparent to those of ordinary skill in the art that other embodiments and implementations are possible that are within the scope of this invention. Accordingly, the invention is not restricted except in light of the attached claims and their equivalents.

What is claimed is: